

Application No. 10/064,220  
Amendment and Election dated March 15, 2006  
Reply to Office Action of July 1, 2005

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims 1-36 (cancelled)

Claim 37 (new) A chemical delivery system for delivering an ultrapure chemical to a point of use, comprising:

- a chemical container apparatus comprising a sealed chemical container adapted for containing an ultrapure chemical;

- a recharge container apparatus comprising a recharge container adapted for containing the ultrapure chemical after receipt of the ultrapure chemical from the chemical container apparatus;

- a source of a high pressure inert gas;

- a pressurization gas apparatus adapted to receive the high pressure inert gas and deliver the high pressure inert gas to the chemical container apparatus and the recharge container apparatus;

- a first connection joint between and in fluid communication with the chemical container apparatus and the pressurization gas apparatus;

- a second connection joint between and in fluid communication with the chemical container apparatus and the recharge container apparatus;

- a third connection joint between and in fluid communication with the recharge container apparatus and pressurization apparatuses;

- a source of a purge gas, wherein the purge gas is the same as or different from the high pressure inert gas;

- a purge gas apparatus adapted to receive the purge gas and deliver the purge gas to the chemical container apparatus;

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a fourth connection joint between and in fluid communication with the chemical container apparatus and the purge gas apparatus;

a vacuum apparatus adapted to create a vacuum;

a fifth connection joint between and in fluid communication between the vacuum apparatus and either the chemical container apparatus or the recharge container apparatus,

a solvent supply apparatus adapted to receive the pressurization gas from the pressurization gas apparatus and thereby pressurize a solvent and being further adapted to supply the pressurized solvent to the chemical container apparatus;

a sixth connection joint between and in fluid communication with the pressurization gas apparatus and the solvent supply apparatus; and

a seventh connection joint between and in fluid communication with the solvent supply apparatus and the chemical container apparatus.

38 (new) The chemical delivery system of claim 37, wherein the chemical container apparatus comprises a chemical container gas inlet conduit extending between and in fluid communication between the first connection joint and the sealed chemical container, a chemical container chemical outlet conduit extending between and in fluid communication between the sealed chemical container and the second connection joint, a chemical container bypass conduit extending between and in fluid communication with the chemical container gas inlet and outlet conduits, a chemical container discharge conduit, and a chemical container level indicator adapted to monitor a level of ultrapure chemical when the ultrapure chemical is present in the sealed chemical container, wherein:

the chemical container gas inlet conduit comprises:

- a first chemical container disconnection joint in fluid communication with the first connection joint, and

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- a first chemical container isolation valve in fluid communication between the first connection joint and the sealed container;

the chemical container chemical outlet conduit comprises:

- a second chemical container disconnection joint in fluid communication with the second connection joint, the first and second chemical container disconnection joints being adapted to allow the sealed chemical container to be reversibly removed from the chemical delivery system,
- a chemical container diptube with a first end extending into the sealed chemical container, and
- a second chemical container isolation valve in fluid communication between the second chemical container disconnection joint and a second end of the chemical container diptube; and

the chemical container discharge conduit comprises:

- a chemical container waste outlet conduit,
- a chemical container waste inlet conduit in fluid communication with either or both of the chemical container gas inlet conduit and the chemical container chemical outlet conduit, and
- a chemical container control valve in fluid communication between the chemical container waste inlet and outlet conduits.

39 (new) The chemical delivery system of claim 37, wherein:

the recharge container apparatus comprises

- a recharge container chemical inlet conduit extending between and in fluid communication between the second connection joint and the sealed recharge container,

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- a recharge container gas inlet conduit extending between and in fluid communication between the second connection joint and the sealed recharge container,
  - a recharge container chemical delivery conduit extending between and in fluid communication with the sealed recharge container,
  - a recharge container level monitor associated with the sealed recharge container adapted to monitor a level of ultrapure chemical when it is present in the sealed recharge container, and
  - a recharge container gas discharge conduit;
- the recharge container chemical inlet conduit comprises
- a first recharge container control valve in fluid communication with the second connection joint,
  - a first recharge container isolation valve in fluid communication with the sealed recharge container,
  - a first recharge container disconnection joint in fluid communication between the first recharge container control valve and the first recharge container isolation valve;
- the recharge container gas inlet conduit comprises
- a second recharge container isolation valve in fluid communication with the sealed recharge container, and
  - a second recharge container disconnection joint in fluid communication between the second recharge container control valve and the third connection joint;
- the recharge container chemical delivery conduit comprises, in order
- a diptube with a first end extending into the sealed recharge container.
  - a third recharge container isolation valve,

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- a third recharge container disconnection joint, wherein the first, second, and third recharge container disconnection joints are adapted to allow the sealed container to be reversibly removed from the chemical delivery system; and

the recharge container gas discharge conduit comprises, in order:

- a second recharge container control valve in fluid communication with the recharge container gas inlet conduit at a point between the third connection joint and second recharge container disconnection joint, and
- a needle valve.

40 (new) The chemical delivery system of claim 37, further comprising a waste recovery apparatus, an eighth connection joint in fluid communication between the chemical container apparatus and the waste recovery apparatus, and an exhaust line, wherein:

the waste recovery apparatus comprises

- a sealed waste recovery container,
- a waste recovery inlet in fluid communication with and extending between the eighth connection joint and the sealed waste recovery container,
- a waste recovery outlet extending between and in fluid communication with the exhaust line and the sealed waste container,
- a waste recovery bypass conduit extending between and in fluid communication between the waste recovery inlet and outlet conduits;

the waste recovery inlet comprises, in order from the eighth connection joint to the sealed waste recovery container

- a first waste recovery control valve,
- a first waste recovery disconnection joint, and

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- a first waste recovery isolation valve; and  
the waste recovery exhaust comprises, in order from the sealed waste recovery container to the exhaust line
- a second waste recovery isolation valve,
- a second waste recovery disconnection joint, wherein the first and second waste recovery disconnection joints are adapted to allow the sealed waste recovery container to be reversibly removed from the chemical delivery system, and
- a second waste recovery control valve.

41 (new) The chemical delivery system of claim 37, wherein the vacuum apparatus is in fluid communication with one, two, three, or all four of the chemical container apparatus, the recharge container apparatus, the solvent supply apparatus, and the waste recovery apparatus.

42 (new) The chemical delivery system of claim 37, further comprising an exhaust line, a degassing apparatus in fluid communication with the exhaust, and a ninth connection joint in fluid communication between the recharge container apparatus and the degas apparatus, wherein the degas apparatus comprises:

- a degas chemical inlet conduit,
- a membrane adapted to separate dissolved gas from liquid in ultrapure chemical flowing from the degas chemical inlet and through the membrane, the degas chemical inlet conduit being in fluid communication between the ninth connection joint to the membrane,
- a degassing chemical outlet conduit adapted to receive degassed ultrapure chemical from the membrane, and
- a degassing exhaust conduit extending between and in fluid communication with the membrane and the exhaust line, the degas exhaust conduit being adapted to receive gas separated from the ultrapure chemical by the membrane.

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43 (new) The chemical delivery system of claim 37, further comprising a tenth connection joint in fluid communication with a filtration apparatus, wherein:

the tenth connection joint is in fluid communication between the filtration apparatus and either the recharge container apparatus or the degassing apparatus; and

the filtration apparatus comprises, in order from the tenth connection joint, a filtration chemical inlet, at least one filter, and a filtration chemical outlet.

44 (new) The chemical delivery system of claim 37, wherein the recharge container chemical delivery conduit is adapted to delivery ultrapure chemical to a vaporizer.

45 (new) The chemical delivery system of claim 37, wherein the vacuum generator is a venturi or a vacuum pump.

46 (new) The chemical delivery system of claim 37, further comprising a tenth connection joint in fluid communication with a filtration apparatus, wherein:

the tenth connection joint is in fluid communication between the filtration apparatus and either the recharge container apparatus or the degassing apparatus; and

the filtration apparatus comprises:

a filtration chemical inlet,

a first filtration chemical inlet conduit,

a second filtration chemical inlet conduit,

a first upstream filtration isolation valve, the first filtration chemical inlet conduit being in fluid communication between the filtration chemical inlet and the first upstream filtration isolation valve,

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a second upstream filtration isolation valve, the second filtration chemical inlet conduit being in fluid communication between the filtration chemical inlet and the second upstream filtration isolation valve,  
a first filter,  
a second filter,  
a first downstream filtration isolation valve, the first filter being in fluid communication between the first upstream filtration isolation valve and the first downstream filtration isolation valve,  
a second downstream filtration isolation valve, the second filter being in fluid communication between the second upstream filtration isolation valve and the second downstream filtration isolation valve,  
a first filtration chemical outlet conduit,  
a second filtration chemical outlet conduit, and  
a filtration chemical outlet, the first filtration chemical outlet conduit being in fluid communication between the first downstream filtration isolation valve and the filtration chemical outlet, the second filtration chemical outlet conduit being in fluid communication between the second downstream filtration isolation valve and the filtration chemical outlet.

47 (new) The chemical delivery system of claim 37, wherein the purge and pressurization gases are not the same.

48 (new) The chemical delivery system of claim 38, further comprising an exhaust line, a degassing apparatus in fluid communication with the exhaust, and a ninth connection joint in fluid communication between the recharge container apparatus and the degas apparatus, wherein the degas apparatus comprises:

a degas chemical inlet conduit,  
a membrane adapted to separate dissolved gas from liquid in ultrapure chemical flowing from the degas chemical inlet and through the membrane, the



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degas chemical inlet conduit being in fluid communication between the ninth connection joint to the membrane,

a degassing chemical outlet conduit adapted to receive degassed ultrapure chemical from the membrane, and

a degassing exhaust conduit extending between and in fluid communication with the membrane and the exhaust line, the degas exhaust conduit being adapted to receive gas separated from the ultrapure chemical by the membrane.

49 (new) The chemical delivery system of claim 39, further comprising an exhaust line, a degassing apparatus in fluid communication with the exhaust, and a ninth connection joint in fluid communication between the recharge container apparatus and the degas apparatus, wherein the degas apparatus comprises:

a degas chemical inlet conduit,

a membrane adapted to separate dissolved gas from liquid in ultrapure chemical flowing from the degas chemical inlet and through the membrane, the degas chemical inlet conduit being in fluid communication between the ninth connection joint to the membrane,

a degassing chemical outlet conduit adapted to receive degassed ultrapure chemical from the membrane, and

a degassing exhaust conduit extending between and in fluid communication with the membrane and the exhaust line, the degas exhaust conduit being adapted to receive gas separated from the ultrapure chemical by the membrane.

50 (new) The chemical delivery system of claim 40, further comprising an exhaust line, a degassing apparatus in fluid communication with the exhaust, and a ninth connection joint in fluid communication between the recharge container apparatus and the degas apparatus, wherein the degas apparatus comprises:

a degas chemical inlet conduit,

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a membrane adapted to separate dissolved gas from liquid in ultrapure chemical flowing from the degas chemical inlet and through the membrane, the degas chemical inlet conduit being in fluid communication between the ninth connection joint to the membrane,

a degassing chemical outlet conduit adapted to receive degassed ultrapure chemical from the membrane, and

a degassing exhaust conduit extending between and in fluid communication with the membrane and the exhaust line, the degas exhaust conduit being adapted to receive gas separated from the ultrapure chemical by the membrane.

51 (new) The chemical delivery system of claim 38, further comprising a tenth connection joint in fluid communication with a filtration apparatus, wherein:

the tenth connection joint is in fluid communication between the filtration apparatus and either the recharge container apparatus or the degassing apparatus; and

the filtration apparatus comprises, in order from the tenth connection joint, a filtration chemical inlet, at least one filter, and a filtration chemical outlet.

52 (new) The chemical delivery system of claim 39, further comprising a tenth connection joint in fluid communication with a filtration apparatus, wherein:

the tenth connection joint is in fluid communication between the filtration apparatus and either the recharge container apparatus or the degassing apparatus; and

the filtration apparatus comprises, in order from the tenth connection joint, a filtration chemical inlet, at least one filter, and a filtration chemical outlet.

53 (new) The chemical delivery system of claim 40, further comprising a tenth connection joint in fluid communication with a filtration apparatus, wherein:

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the tenth connection joint is in fluid communication between the filtration apparatus and either the recharge container apparatus or the degassing apparatus; and

the filtration apparatus comprises, in order from the tenth connection joint, a filtration chemical inlet, at least one filter, and a filtration chemical outlet.

54 (new) The chemical delivery system of claim 48, further comprising a tenth connection joint in fluid communication with a filtration apparatus, wherein:

the tenth connection joint is in fluid communication between the filtration apparatus and either the recharge container apparatus or the degassing apparatus; and

the filtration apparatus comprises, in order from the tenth connection joint, a filtration chemical inlet, at least one filter, and a filtration chemical outlet.

55 (new) The chemical delivery system of claim 49, further comprising a tenth connection joint in fluid communication with a filtration apparatus, wherein:

the tenth connection joint is in fluid communication between the filtration apparatus and either the recharge container apparatus or the degassing apparatus; and

the filtration apparatus comprises, in order from the tenth connection joint, a filtration chemical inlet, at least one filter, and a filtration chemical outlet.

56 (new) The chemical delivery system of claim 50, further comprising a tenth connection joint in fluid communication with a filtration apparatus, wherein:

the tenth connection joint is in fluid communication between the filtration apparatus and either the recharge container apparatus or the degassing apparatus; and

the filtration apparatus comprises, in order from the tenth connection joint, a filtration chemical inlet, at least one filter, and a filtration chemical outlet.

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57 (new) A method for delivering an ultrapure chemical to a point of use, comprising the steps of:

providing a chemical container apparatus comprising

- a sealed chemical container containing an ultrapure chemical, and
- a chemical container chemical outlet conduit extending from the sealed chemical container, and
- a chemical container level indicator associated with the sealed chemical container adapted to monitor a level of ultrapure chemical in the sealed chemical container;

providing a recharge container apparatus in fluid communication with the chemical container apparatus comprising

- a recharge container chemical inlet conduit,
- sealed recharge container, and
- recharge container chemical delivery conduit, wherein the recharge container chemical inlet conduit extends away from the chemical container chemical outlet conduit towards the sealed recharge container, and the recharge container chemical delivery conduit extends from the sealed recharge container to the point of use;

providing a high pressure inert gas apparatus in fluid communication with the chemical container apparatus and the recharge container apparatus;

supplying the high pressure inert gas from the high pressure inert gas apparatus to an interior of the sealed chemical container so that the ultrapure chemical is subjected to a high pressure and forced through the chemical container chemical delivery outlet;

supplying the high pressure inert gas from the high pressure inert gas apparatus to an interior of the sealed recharge container so that the ultrapure

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chemical is subjected to a high pressure and forced through the recharge container chemical delivery outlet to a point of use; and

controlling performance of the method steps with an automatic control apparatus connected by communication lines with the chemical container apparatus, the recharge container apparatus, and the pressurization gas apparatus, wherein ultrapure chemical forced from the sealed chemical container through the chemical container delivery outlet is received by the sealed recharge container chemical inlet conduit.

58 (new) The method according to claim 57, further comprising one or more of the following steps:

supplying a purge gas to the chemical container apparatus with a purge gas apparatus connected to the chemical container apparatus so that an interior of the chemical container apparatus is purged;

subjecting an interior of the chemical container apparatus to a vacuum with a vacuum apparatus connected to the chemical container apparatus;

subjecting an interior of the recharge container apparatus to a vacuum with a vacuum apparatus connected to the recharge container apparatus;

supplying a solvent to the chemical container apparatus with a solvent supply apparatus connected to the chemical container apparatus so that residues within the chemical container apparatus are rinsed out;

exhausting an interior of the chemical container apparatus to an exhaust line;

exhausting an interior of the recharge container apparatus to an exhaust line;

collecting waste substances from the chemical container apparatus into a chemical waste apparatus;

collecting waste substances from the recharge container apparatus into a chemical waste apparatus;

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degassing ultrapure chemical forced through the recharge container chemical delivery conduit so that dissolved gas is separated from the ultrapure chemical; and

filtering ultrapure chemical forced through the recharge container chemical delivery conduit.

59 (new) The method according to claim 57, further comprising the step of supplying a solvent to the chemical container apparatus with a solvent supply apparatus connected to the chemical container apparatus so that residues within the chemical container apparatus are rinsed out, wherein the solvent is selected from the group consisting of: isopropanol, tetrahydrofuran, isopropanol/tetrahydrofuran mixtures, tetraglyme, xylene, toluene, butyl acetate, benzonitrile, ethanol, hexane, octane, or mixtures thereof.

60 (new) A method according to claim 57, wherein the point of use is a vaporizer.

61 (new) A method according to claim 57, wherein the point of use is a manufacturing process tool.

62 (new) A method according to claim 57, wherein the point of use is an electronic fabrication tool.

63 (new) A method according to claim 57, wherein the point of use is an optical fiber manufacture tool.

64 (new) A method according to claim 57, wherein the point of use is a semiconductor process tool.

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65 (new) A method according to claim 57, wherein the ultrapure chemical is selected from tetramethylsilane, dimethyl-dimethoxy-silane, copper(II)bis(hexafluoroacetylacetonate), copper(II)hexafluoroacetylacetonate, tetramethylvinylsilane, triisobutylaluminum, trimethylaminalane, triethylaminalane, dimethylethylaminalane, bis(trimethylamin)alane, dimethylaluminumhydride, titanium tetrachloride, tetrakisdimethylamino titanium (TDMAT), tetra-kisdiethylamino tantalum ( $\text{Ta}(\text{Net})_4$ ), penta-kisdiethylamino tantulum ( $\text{Ta}(\text{Net})_5$ ), tantalum pentachloride ( $\text{TaCl}_5$ ), tungsten hexocarbonyl ( $\text{W}(\text{CO})_6$ ), bisdipivaloylmethanato barium ( $\text{Ba}(\text{DPM})_2$ ), bisdipivaloylmethanato strontium ( $\text{Sr}(\text{DPM})_2$ ), bis-isopropoxy bisdipivaloylmethanato titanium  $\text{Ti}(\text{I-OC}_3\text{H}_7)_2\text{DPM}_2$ , trimethylaluminum (TMA), tetrakisdimethylamino zirconium ( $\text{Zr}(\text{NME})_4$ ), tetrakisdiethylamino zirconium ( $\text{Zr}(\text{Net})_4$ ), zirconium t-Butoxide ( $\text{Zr}(\text{t-OBu})_4$ ), tetrakisdiethylamino hafnium ( $\text{Hf}(\text{Net})_4$ ), tetrakisdimethylamino hafnium ( $\text{Hf}(\text{NME})_4$ ), hafnium t-Butoxide ( $\text{Hf}(\text{t-Obu})_4$ ), trihexafluoroacetylacetate platinum ( $\text{Pt}(\text{Hfa})_3$ ), bis(ethylcyclopentadienyl) ruthenium ( $\text{EtCp}_2\text{Ru}$ ), acetylacetate iridium ( $\text{Ir}(\text{Acac})$ ), dipivaloylmethane compounds, alkoxide compounds, bisdipivaloylmethanato lead ( $\text{Pb}(\text{DPM})_2$ ), bisdipivaloylmethanato zirconium ( $\text{Zr}(\text{DPM})_4$ ), trimethyl bismuth ( $\text{BiMe}_3$ ), tetraethylorthosilicate (TEOS), tantalum pentaethoxide ( $\text{Ta}(\text{OEt})_5$ ), tetramethylcyclotetrasiloxane (TMCTS), bis(tertiary-butylamino)silane (BTBAS), trimethylphosphate (TMPO), trimethylborate (TMB), or trimethylphosphite (TMPI)

66 (new) The method according to claim 57, further comprising the step of supplying a purge gas to the chemical container apparatus with a purge gas apparatus connected to the chemical container apparatus so that an interior of the chemical container apparatus is purged, wherein the purge and pressurization gases are different.

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67 (new) The method according to claim 57, further comprising the steps of:  
optionally discontinuing receipt of the ultrapure chemical into the sealed  
recharge container chemical inlet conduit from the chemical container delivery  
outlet is received by the sealed recharge container chemical inlet conduit; and  
allowing the ultrapure chemical forced from the chemical container delivery  
outlet to the point of use.

68 (new) A method according to claim 67, wherein the point of use is a  
vaporizer.

69 (new) A method according to claim 58, wherein the point of use is a  
manufacturing process tool.

70 (new) A method according to claim 58, wherein the point of use is an  
electronic fabrication tool.

71 (new) A method according to claim 58, wherein the point of use is an  
optical fiber manufacture tool.

72 (new) A method according to claim 58, wherein the point of use is a  
semiconductor process tool.



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